

PATENT COOPERATION TREATY

From the:
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

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PCT WRITTEN OPINION (PCT Rule 66)

Date of mailing
(day/month/year) **27 MAY 2005**

Applicant's or agent's file reference
TING/20302314/KC/kt

REPLY DUE within **TWO MONTHS**
from the above date of mailing

International Application No.
PCT/SG2003/000223

International Filing Date (day/month/year)
19 September 2003

Priority Date (day/month/year)
19 September 2003

International Patent Classification (IPC) or both national classification and IPC
Int. Cl. ⁷ **H01L 21/4763, 21/285, 23/36, 23/367, 23/373, 31/024, 31/052, 31/18, H01S 5/024**

Applicant
TINGGI TECHNOLOGIES PRIVATE LIMITED et al

1. This written opinion is the **second** drawn by this International Preliminary Examining Authority.

2. This opinion contains indications relating to the following items:

- I ☒ Basis of the opinion
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☒ Certain observations on the international application

3. The **FINAL DATE** by which the international preliminary examination report must be established according to Rule 69.2 is:
19 January 2006

4. The applicant is hereby **invited to reply** to this opinion.

When? See the **Reply Due** date indicated above. However, the Australian Patent Office will not establish the Report before the earlier of (i) a response being filed, or (ii) one month before the **Final Date** by which the international preliminary examination report must be established. The Report will take into account any response (including amendments) filed before the Report is established. **If no response is filed by 1 month before the Final Date, the international preliminary examination report will be established on the basis of this opinion.**
Applicants wishing to have the benefit of a further opinion (if needed) before the report is established should ensure that a response is filed at least **3 months before the Final Date** by which the international preliminary examination report must be established.

How? By submitting a written reply, accompanied, where appropriate, by amendments, according to Rule 66.3.
For the form and the language of the amendments, see Rules 66.8 and 66.9.

Also For an additional opportunity to submit amendments, see Rule 66.4.
For the examiner's obligation to consider amendments and/or arguments, see Rule 66.4bis.
For an informal communication with the examiner, see Rule 66.6.

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I. Basis of the opinion**1. With regard to the elements of the international application:***

- ☒ the international application as originally filed.
- ☐ the description, pages , as originally filed,
pages , filed with the demand,
pages , received on with the letter of
- ☐ the claims, pages , as originally filed,
pages , as amended under Article 19,
pages , filed with the demand,
pages , received on with the letter of
- ☐ the drawings, pages , as originally filed,
pages , filed with the demand,
pages , received on with the letter of
- ☐ the sequence listing part of the description:
pages , as originally filed
pages , filed with the demand
pages , received on with the letter of

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the written opinion was drawn on the basis of the sequence listing:

- ☐ contained in the international application in printed form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/fig.

5. ☐ This opinion has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this opinion as "originally filed"

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims 1-28, 30-31, 33-35, 38-53	YES
	Claims 29, 32, 36-37	NO
Inventive step (IS)	Claims 1-28, 43-53	YES
	Claims 29-42	NO
Industrial applicability (IA)	Claims 1-53	YES
	Claims	NO

2. Citations and explanations

Citation

D1 : US 6562648 B1

NOVELTY (N) claims 29, 32, 36-37

D1 teaches, referring to either of Figures 2b or 3b thereof, a semiconductor laser diode device comprising InGaN epitaxial layers 1110, first ohmic contact 1118, a copper heat sink layer 1119 of thickness 100-500 microns applied by electroplating; and a second ohmic contact 1020 (see also column 4 line 54, column 5 lines 27-28, and column 7 lines 21-42 of D1). Hence all features of claims 29, 32, 36 and 37 are disclosed, and these claims lack novelty in the light of D1.

INVENTIVE STEP (S) claims 29-42

Claims 29, 32, 36-37: as above

Claims 30-31, 33-35, 38-42: The additional features of these claims are obvious selections from common general knowledge in the art for carrying out the teachings of D1 (where it is well known, in particular, to use a seed layer in copper electroplating), and hence these claims lack an inventive step in the light of D1.

No obvious combination of the prior art teaches or suggests electroplating a layer of conductive metal on a semiconductor device formed on a substrate and then removing the substrate, as per claims 1-28, 48-53; nor forming a first ohmic contact on GaN-related epitaxial layers of a semiconductor device formed on a substrate, removing the substrate, and forming a second ohmic contact as per claims 43-47 (note item 2 of Box VIII with respect to the interpretation of these claims). Hence these claims are considered to be novel and inventive.

INDUSTRIAL APPLICABILITY (IA) claims 1-53

The subject matter of the claims is applicable to the industrial manufacture of GaN semiconductor devices.

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

1. The claims as a whole are not clear and do not relate to a single invention. Independent claims 1, 29, 38, 43, 48 and 50 are each characterised by their own set of technical features. It is therefore not clear which technical features define the scope of the monopoly sought. Each independent claim appears to include technical features that are missing from another independent claim. It is therefore not clear whether such features are essential to defining the invention.
2. The claims are unclear with respect to the use of the term "wafer" (eg, independent claims 1, 43, 48 and 50), and the distinction between this term and "substrate". In common usage, a "wafer" typically refers to the common substrate on which a plurality of devices are formed. However, in Figure 1 the wafer 10 appears to refer to all elements of the devices, including the "substrate"; while in independent claims 1, 48 and 50 it appears that the wafer refers only to the device layers. For the purposes of this report I have taken "wafer" and "substrate" to be the same, and to refer to the layer on which the semiconductor devices of the claims are formed.

I note that if the claims are amended to indicate otherwise, then claims 1, 43, 48 and 50 may have novelty or inventive step objections raised (eg, Figures 2a and 2b of D1 show a copper layer electroplated on a 'wafer' device 1110, 1106, 1105, on the side remote from a 'substrate' 1105, with ohmic contacts 1020 and 1118, and with subsequent removal of the 'substrate' 1105).

3. Independent claims 1 and 29 are not clear with respect to "a relatively thick layer" (eg, line 5 of claim 1), and in particular whether 'relative' is in respect of the seed layer, the device layers, or the substrate. Perhaps it would be clearer if a functional criterion was given, such as sufficient thickness to provide a heat sink or mechanical support.
4. Independent claims 38 and 43 are not fully supported by the description, because they do not include the feature of an electroplated thick metal layer. Hence the defined features of these claims do not solve the problems of the prior art discussed at pages 1-3 of the instant application, and do not fully define the described solution to these problems.
5. Claim 38 is not clear with respect to the function of the seed layer. The description only supports the use of such a layer in conjunction with an electroplated metal layer. Hence such an electroplated layer should be a feature of this claim (see also item 4 above).